**PCT** WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : A46B 5/00 — A1

(11) International Publication Number: **WO 99/39610**

(43) International Publication Date: 12 August 1999 (12.08.99)

(21) International Application Number: PCT/EP99/00609

(22) International Filing Date: 29 January 1999 (29.01.99)

(30) Priority Data:
9802248.6 4 February 1998 (04.02.98) GB

(71) Applicant *(for all designated States except US)*: SMITHKLINE BEECHAM GMBH AND CO. KG [DE/DE]; Hermannstrasse 7, D–77815 Buhl (DE).

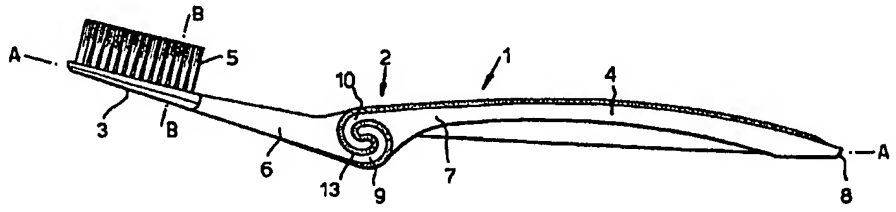
(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: HALM, Hans [DE/ES]; Cami des Selinar, 34, E–07160 Camp de Mar (ES).

(74) Agent: WALKER, Ralph, Francis; SmithKline Beecham, Corporate Intellectual Property, Two New Horizons Court, Brentford, Middlesex TW8 9EP (GB).

(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

**Published**
*With international search report.*
*Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.*

(54) Title: TOOTHBRUSH




(57) Abstract

A toothbrush (1) made of a plastic material, having a resiliently flexible link (2) being formed between the head (3) and the handle (4). The link comprises a first plastic material part extending integrally from the head end toward the handle end, and a second plastic material part extending integrally from the handle end toward the head end, the first and second parts overlapping each other longitudinally, between the said first and second plastic material parts there being a resilient flexible elastomeric material (13).

*FOR THE PURPOSES OF INFORMATION ONLY*

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **AL** | Albania | **ES** | Spain | **LS** | Lesotho | **SI** | Slovenia |
| **AM** | Armenia | **FI** | Finland | **LT** | Lithuania | **SK** | Slovakia |
| **AT** | Austria | **FR** | France | **LU** | Luxembourg | **SN** | Senegal |
| **AU** | Australia | **GA** | Gabon | **LV** | Latvia | **SZ** | Swaziland |
| **AZ** | Azerbaijan | **GB** | United Kingdom | **MC** | Monaco | **TD** | Chad |
| **BA** | Bosnia and Herzegovina | **GE** | Georgia | **MD** | Republic of Moldova | **TG** | Togo |
| **BB** | Barbados | **GH** | Ghana | **MG** | Madagascar | **TJ** | Tajikistan |
| **BE** | Belgium | **GN** | Guinea | **MK** | The former Yugoslav Republic of Macedonia | **TM** | Turkmenistan |
| **BF** | Burkina Faso | **GR** | Greece | | | **TR** | Turkey |
| **BG** | Bulgaria | **HU** | Hungary | **ML** | Mali | **TT** | Trinidad and Tobago |
| **BJ** | Benin | **IE** | Ireland | **MN** | Mongolia | **UA** | Ukraine |
| **BR** | Brazil | **IL** | Israel | **MR** | Mauritania | **UG** | Uganda |
| **BY** | Belarus | **IS** | Iceland | **MW** | Malawi | **US** | United States of America |
| **CA** | Canada | **IT** | Italy | **MX** | Mexico | **UZ** | Uzbekistan |
| **CF** | Central African Republic | **JP** | Japan | **NE** | Niger | **VN** | Viet Nam |
| **CG** | Congo | **KE** | Kenya | **NL** | Netherlands | **YU** | Yugoslavia |
| **CH** | Switzerland | **KG** | Kyrgyzstan | **NO** | Norway | **ZW** | Zimbabwe |
| **CI** | Côte d'Ivoire | **KP** | Democratic People's Republic of Korea | **NZ** | New Zealand | | |
| **CM** | Cameroon | | | **PL** | Poland | | |
| **CN** | China | **KR** | Republic of Korea | **PT** | Portugal | | |
| **CU** | Cuba | **KZ** | Kazakstan | **RO** | Romania | | |
| **CZ** | Czech Republic | **LC** | Saint Lucia | **RU** | Russian Federation | | |
| **DE** | Germany | **LI** | Liechtenstein | **SD** | Sudan | | |
| **DK** | Denmark | **LK** | Sri Lanka | **SE** | Sweden | | |
| **EE** | Estonia | **LR** | Liberia | **SG** | Singapore | | |

# Toothbrush

This invention relates to toothbrushes, particularly toothbrushes for use by hand action and having a flexibility-modifying feature.

Toothbrushes having flexibility-modifying features in their handle are known, for example US 5 054 154 discloses the possibility of a toothbrush having a hinge between its grip handle and its neck, i.e. that part of the toothbrush between the handle and the head. Generally however, the flexibility modifying features of known toothbrushes have been unable to focus the flexibility of the toothbrush at a precise point in the toothbrush structure, so that as a consequence the flexible bending of the toothbrush occurs over a vaguely defined zone. Also precise "tuning" of the flexibility of the toothbrush can be difficult with known constructions.

An object of this invention is to overcome the above-mentioned problems of known toothbrushes and to provide a toothbrush in which flexibility can be focused at a precisely defined location and can be easily tuned independently of selection of particular construction materials for the toothbrush.

According to this invention a toothbrush made of a plastic material is provided, having a head and a grip handle, all disposed along a longitudinal toothbrush axis, bristles projecting from the head in a bristle direction generally perpendicular to the toothbrush axis, the toothbrush having a head end extending from the head toward the handle, and a handle end extending from the end of the handle remote from the head toward the head, a resiliently flexible link being formed between the head end and the handle end, characterised in that;

the link comprises a first plastic material part extending integrally from the head end toward the handle end, and a second plastic material part extending integrally from the handle end toward the head end, the first and second parts overlapping each other longitudinally on either side of an axis substantially parallel to the longitudinal axis and substantially perpendicular to the bristle direction,

between the said first and second plastic material parts there being a resilient flexible elastomeric material bonded to both the first and second plastic material parts.

According to another aspect of this invention the toothbrush is made of a plastic material is provided, having a head and a grip handle, all disposed along a longitudinal toothbrush axis, bristles projecting from the head in a bristle direction generally perpendicular to the toothbrush axis, the toothbrush having a resiliently flexible link being formed between the head end and the handle end, characterised in that;

the link comprises a first plastic material part extending integrally from a part of the toothbrush which is relatively nearer to the head, toward the handle, and a second plastic material part extending integrally from a part of the toothbrush which is relatively nearer to the handle, toward the head, the first and second parts overlapping each other longitudinally on either side of an axis substantially parallel to the longitudinal axis and substantially perpendicular to the bristle direction,

between the said first and second plastic material parts there being a resilient flexible elastomeric material bonded to both the first and second plastic material parts.

The longitudinal toothbrush axis as referred to herein is that axis which links the longitudinal extremities of the toothbrush at the respective longitudinal ends of the head and the handle. The axis substantially parallel to the longitudinal axis and substantially perpendicular to the bristle direction may in fact be the longitudinal toothbrush axis.

The "thickness" of the toothbrush as referred to herein is that dimension of the toothbrush in the direction perpendicular to the longitudinal axis direction and generally parallel to the bristle direction.

The "width" of the toothbrush as referred to herein is that dimension of the toothbrush in the direction perpendicular to the longitudinal axis direction and generally perpendicular to the bristle direction.

The link may be located at any point in the toothbrush between the head and the handle, but preferably the toothbrush comprises a head, a neck region and a handle arranged successively longitudinally along the toothbrush, and the link is located between the handle and the neck region. Typically the neck region of a toothbrush is that part of the toothbrush which extends for a distance of ca. 1 - 1.5 times the length of the head, from the base (i.e. the part of the head nearest the

handle) of the head toward the handle. In a preferred embodiment the first and second parts describe bends in the same rotational direction around respective axes aligned substantially in the width direction , i.e. axes aligned substantially widthwise relative to the toothbrush, to form concave surfaces on the inside of the bend, and the respective concave surfaces of the first and second parts face each other.

The said bends may each be curved, e.g. of generally part circular or part elliptical cross section about their respective axis, so that the bends are generally of part cylindrical shape. For example the first and second parts may describe arcs of generally "L", "J", "C" or "U" shape, with the axis of the bend of the "L", "J", "C" or "U" shape aligned widthwise across the toothbrush. Alternatively the said bends may be angular rather than curved, for example part polygonal cross section about their respective axis. The term "polygonal" as used herein includes triangular, square, rectangular, pentagonal, hexagonal, heptagonal, octagonal etc.

In this preferred embodiment the respective first and second parts may describe bends which are sufficiently tight, e.g. are of small enough radius of curvature, that the first and second parts cut the abovementioned axis substantially parallel to the longitudinal axis and substantially perpendicular to the bristle direction. For example the radius of curvature may be less than the thickness of the toothbrush in the region of overlap of the first and second parts, for example less than half the thickness of the toothbrush. By such a radius of curvature the first and second parts may bend around to such an extent that that they bend right round through 180° or more and extend back in the opposite direction to that from which they extend from their origin at respectively the head end or handle end. For example the radius of curvature may decrease with progressive extension of the part from respectively the head end or handle end, so that the part describes a spiral or part spiral curve.

For example the respective first and second parts may hook around each other. By "hook around" is meant that that the first and second parts are bent as described above, and the inner concave surfaces of their bends face each other across a gap in the plastic material between them. In particular in the case of "J", "U" or "C" shaped bends, the respective extremity of the first part which is

remotest from the head points generally toward the head, and the end of the second part which is remotest from the handle points generally toward the handle. For the first and second parts to hook around each other an extremity of a "J", "C" or "U" shaped first or second part may fit into the convexity of the curve of the respective second or first part. These said extremities may overlap each other longitudinally on either side of the abovementioned axis substantially parallel to the longitudinal axis and substantially perpendicular to the bristle direction.

Therefore in a preferred embodiment of this invention a toothbrush made of a plastic material is provided, having a head and a grip handle, all disposed along a longitudinal toothbrush axis, bristles projecting from the head in a bristle direction generally perpendicular to the toothbrush axis, the toothbrush having a head end extending from the head toward the handle, and a handle end extending from the end of the handle remote from the head toward the head,

a resiliently flexible link being formed between the head end and the handle end, characterised in that;

the link comprises a first plastic material part extending integrally from the head end toward the handle end, and a second plastic material part extending integrally from the handle end toward the head end,

the first and second parts being bent around respective axes aligned widthwise to the toothbrush, the bent first and second parts being hooked about each other,

between the said first and second plastic material parts there being a resilient flexible elastomeric material bonded to both the first and second plastic material parts.

In alternative terms the toothbrush has a resiliently flexible link being formed between the head and the handle, the link comprising a first plastic material part extending integrally from the head end toward the handle end, and a second plastic material part extending integrally from the handle end toward the head end,

the first and second parts being bent around respective axes aligned widthwise to the toothbrush, the bent first and second parts so formed being hooked about each other,

between the said first and second plastic material parts there being a resilient flexible elastomeric material bonded to both the first and second plastic material parts.

In the toothbrush of this invention, between the first and second plastic material parts there is a gap which is occupied by the elastomeric material of the link. Preferably this gap is open on one or preferably both sides of the toothbrush across the width of the toothbrush so that the elastomer material is exposed on such side(s). If the first and second parts are hooked around each other as described above, and/or are bent in a small radius of curvature, the gap may define a sinuous, tortuous channel through the toothbrush, which may extend from the top surface of the toothbrush (i.e. the surface facing generally in the bristle direction) across the thickness of the toothbrush to the opposite lower surface. Such a sinuous tortuous channel between the first and second parts essentially comprises a structure in which layers of rigid plastic material alternate with layers of flexible elastomeric material across the thickness dimension of the toothbrush. Alternatively if the radius of curvature of the first and second parts is larger, the gap in the plastic material between them may define a substantially cylindrical cavity with its cylindrical cavity extending across the width of the toothbrush. Such a cylindrical cavity, when occupied by the elastomeric material may function as a torsion bar contributing to the flexibility of the toothbrush. The elastomer material may be formed into grip-enhancement pads over the upper and/or lower surfaces of the toothbrush. The thickness (i.e. the dimension generally in the bristle direction) of the first and second parts may each typically be 0.1 - 0.45, suitably 0.1 - 0.2 of the thickness of the toothbrush in the region where they overlap. The elastomeric material may make up the remainder of the thickness of the toothbrush. The thickness of the first and second parts may remain substantially constant, or the first and second parts may taper in thickness over their length, e.g. being thickest at the place where they meet respectively the head end or the handle end and becoming less thick toward their respective extremities. It may be convenient for the thickness of the toothbrush to increase in the region of the flexible link, relative to the parts of the toothbrush immediately adjacent toward the head or handle, to accommodate the link.

The head end and handle end may be made as independent separate parts which are fitted together, e.g. as plastic material parts with their respective first and second parts arranged as in the final toothbrush product to be made, leaving a gap in the plastic material parts between the assembled first and second parts, and the elastomer material may then be then injected into the gap. Alternatively the head end and handle end may be made integrally of plastic material with such a gap between their respective first and second parts, and may have a link part of plastic material linking them, e.g. across the gap. This link part may for example comprise a residual small link of plastic material remaining from the use of a moulding conduit in the injection mould in which the plastic material parts of the toothbrush are moulded. Such a link part may or alternatively need not contribute to the flexibility or strength of the link. The plastic material parts may be formed first in such an injection moulding process, as is common in the field of toothbrush injection moulding, leaving a gap in the plastic material parts between the so-formed first and second parts, and the elastomer material may then be then injected into the gap. By selection of suitable injection moulding conditions for the injection of the elastomer material into the gap, e.g. of temperature and pressure in the injection mould the plastic material and elastomeric parts may be caused to bond together, e.g. by surface fusion. Such conditions are known to those skilled in the art of injection moulding.

According to a further aspect of this invention an injection mould is provided suitable for making therein a toothbrush of the above aspects of this invention, or a part thereof. The general mode of construction and operation of such an injection mould, and its ancillary features such as gates for the injection of plastic and elastomer material will be apparent to those skilled in the art of toothbrush manufacture.

The invention accordingly also provides a process for the manufacture of a toothbrush as described above, for example a process using an injection mould as described above.

By means of the above described construction of the toothbrush of the invention the flexibility of the toothbrush may be made independent of the plastic material of the toothbrush and for example can be determined by the composition,

amount or shape of the elastomeric material present in the link. Moreover the flexibility of the handle can be determined by the position and construction of the link, so as to focus flexibility at a precise point in the toothbrush.

The plastic material and elastomeric material, and the bristle material may be entirely conventional plastic, elastomer and bristle materials for example as used at present in known toothbrushes made of plastic materials and having a flexible link made of an elastomer, such as the SmithKline Beecham Aquafresh Flex 'N Direct™ toothbrush. Suitable plastics materials include, for example, polyamides and polypropylenes. An example of a suitable polyamide is the material 'Ultramid B3' (Trade mark, marketed by BASF, Federal Republic of Germany), having a modulus of elasticity (DIN 53452) of 3000. An example of a suitable polypropylene is the material 'Novolene 1100 HX' (Trade mark, marketed by BASF, Federal Republic of Germany), which is a homopolymer and has a modulus of elasticity (DIN 53457) of 1400. Such a polypropylene homopolymer may optionally be used in admixture with a polypropylene block co-polymer, such as the material 'Novolene 2500 HX' (Trade mark, marketed by BASF, Federal Republic of Germany), for example in an 80 : 20 mixture by weight (1100 HX : 2500 HX). Suitable elastomeric materials include natural or synthetic latex type elastomers, in particular polychloroprene, natural rubber and silicones.

The invention will now be described by way of example only with reference to the accompanying drawings which show:

Figs. 1 and 2 perspective views of two constructions of the toothbrush of this invention.

Figs. 3 and 4 side views of the toothbrush respectively of Figs. 1 and 2.

Figs. 5 and 6 side views of the plastic material parts of two alternative constructions of the toothbrush of Figs. 1 and 2.

Referring to Figs. 1 and 3, a toothbrush 1 of this invention is shown, Fig. 1 showing the flexible link 2 in a perspective view. The toothbrush is made of a plastic material and has a head 3 and a grip handle 4, all disposed along a longitudinal toothbrush axis A--A. Bristles 5 projecting from the head 3 in a bristle direction B--B generally perpendicular to the toothbrush axis A--A. The toothbrush 1 has a head end 6 extending from the head 3 toward the handle 4, and a handle end

7 extending from the end 8 of the handle remote from the head 4 toward the head 4. The head end 6 comprises the head 3, and a part lying between the base of the head 3 and the link 2 comprising a neck region. The link 2 consequently lies between the handle 7 and the neck.

Between the head end 6 and handle end 7 is formed the resiliently flexible link 2. The link 2 comprises a first plastic material part 9 extending integrally from the head end 6 toward the handle end 7, and a second plastic material part 10 extending integrally from the handle end 7 toward the head end 6. The first 9 and second 10 parts overlap each other longitudinally on either side of the axis A--A.

The first 9 and second 10 parts describe curved bends in the same rotational direction, i.e. anticlockwise as viewed in Fig. 1, around respective bend axes C--C and D--D aligned substantially perpendicular to the longitudinal axis A--A and to the bristle direction B--B, i.e. aligned substantially widthwise relative to the toothbrush. These bent first 9 and second 10 parts consequently form concave surfaces 9A, 10A on the inside of the respective bends, and the respective concave surfaces 9A, 10A of the first 9 and second parts 10 face each other.

The said bent parts 9, 10 are curved so as to be of generally part circular or part elliptical cross section about their respective axes C--C, D--D, so that the bent parts 9, 10 are generally of part cylindrical shape. The first and second parts 9, 10 describe arcs of generally "J" shape, with the axis of the bend of the "J" shape aligned widthwise across the toothbrush 1.

The respective first 9 and second 10 parts describe bends which are sufficiently tight, e.g. are of small enough radius of curvature, that the first 9 and second 10 parts are cut by the abovementioned axis A--A. The radius of curvature of the bends of the first and second parts 9, 10 are less than half the thickness of the toothbrush 1 in the region of the link, the thickness being the dimension of the toothbrush in the direction perpendicular to the direction of axis A—A and perpendicular to the width direction of the axes C—C and D—D. This means that the curve of the bend of parts 9 and 10 is sufficiently tight that their extremities bend right round through 180° relative from the orientation of the part 9, 10 at the point where they respectively meet the head end 6 and handle end 7, to point back respectively toward the head 3 and the end of the handle 8. In other words, as seen

more clearly in Fig. 3 the first part 9 bends upward from the lower side of the toothbrush 1 as shown, and crosses the mid point of the thickness dimension of the toothbrush, thereby being cut by the axis A--A. Similarly the second part 10 bends downward from the upper side of the toothbrush 1 as shown, and crosses the mid point of the thickness dimension of the toothbrush, thereby being cut by the axis A--A.

The respective first 9 and second 10 parts hook around each other as shown in Fig. 3. In other words the extremity 11 of the first part 9 which is remotest from the head end 6 points toward the head 3, and the end 12 of the second part 7 which is remotest from the handle end 7 points toward the handle 4. These ends 11,12 overlap each other longitudinally on either side of the abovementioned axis A--A.

Between the first 9 and second 10 plastic material parts there is a resilient flexible elastomeric material 13 bonded to both the first 9 and second 10 plastic material parts. The gap 14 between the plastic material parts 9 and 10 in the toothbrush of Fig. 1 is relatively small, approximating to the thickness of the parts 9 and 10, so that the gap 14 defines a tortuous, sinuous channel across the thickness direction of the toothbrush 1 from the upper surface facing generally in the bristle direction to the lower surface facing in the opposite direction. This channel 14 generally follows the shape of the curve of the parts 9 and 10. The elastomer material 13 occupies this channel 14 and extends out of the channel 14 onto the upper and lower surfaces to form an elastomer material grip-enhancing pad on these surfaces. The elastomer material 13 is exposed on both sides of the toothbrush, i.e. on opposite sides of the width dimension of the toothbrush.

Figs. 2 and 4 show a toothbrush of similar construction to that of Figs. 1 and 3, in which corresponding parts are numbered correspondingly. The radius of curvature of the bent first 9 and second 10 parts is greater than that of the corresponding parts in Figs 1 and 3, such that the extremities 11, 12 of the parts 9 and 10 curve round through an angle of less than 180° relative from the orientation of the part 9, 10 at the point where they respectively meet the head end 6 and handle end 7. Consequently the gap between the parts 9 and 10 in the toothbrush of Fig. 2 is in the form of a substantially cylindrical cavity extending widthways across the toothbrush 1, and this cavity is occupied by the elastomeric material 13.

Consequently a greater quantity of elastomeric material 13 is present between the parts 9 and 10, in the toothbrush of Figs. 2 and 4 than in the toothbrush of Fig. 1, and the mass of elastomer 13 can function as a torsion bar extending widthwise across the toothbrush 1, thereby contributing to resilience and flexibility. The elastomeric material 13 is exposed on both sides of the toothbrush and as in the toothbrush of Fig. 1 extends to form a grip-enhancing pad on the upper and lower surfaces.

Referring to Figs. 5 and 6, only the plastic material parts of the toothbrush of Figs. 1 and 3 are shown. These have been made by an injection moulding process using a mould with a mould cavity of a shape which corresponds accurately to the shape of the parts shown in Fig. 5 and 6. In Fig. 5 the head end 6 and handle end 7 are made as independent separate parts 6, 7. These parts 6, 7 are assembled together in another mould, with their respective first 9 and second 10 parts hooked together as shown, leaving a gap 14 between the first and second parts. An elastomeric material 13 (not shown in Figs. 5 and 6) is then injected into the assembly under conditions of temperature and pressure etc. as known in the art such that the elastomeric material 13 flows into the gap 14 between the first 9 and second 10 parts, and such that the plastic material and elastomeric material 13 bond together, to form the construction shown in Figs. 1 and 3.

As shown in Fig. 6 the head end 6 and handle end 7 are made integrally, with a thin flexible link part 15 of plastic material linking them across the gap 14 between the parts 9 and 10. This link part 15 may be a residual small link of plastic material remaining from the use of a corresponding moulding conduit in the injection mould (not shown) in which the plastic material parts of the toothbrush 1 are moulded. This conduit serves to allow fluid plastic material injected into the cavity which defines the head end 6 into the cavity which defines the handle end 7, or vice versa. This link part 15 can be sufficiently thin that it contributes little or nothing to the resilience and/or flexibility of the link 2 and may be a thin plastic material web. An elastomeric material 13 is then injected into the mould under conditions of temperature and pressure etc. as known in the art such that the elastomeric material 13 flows into the gap 14 between the first 9 and second 10

parts, and such that the plastic material and elastomeric material 13 bond together, to form the construction shown in Figs. 1 and 3.

In use the toothbrushes of Figs. 1, 2, 3 and 4 all function in a similar way, viz. the composite plastic material / elastomeric material structure of the link 2 modifies the flexibility of the toothbrush 1 such that excessive brushing pressure applied to the bristles 5 or head 3 is relieved by the flexible link 2. This modification of flexibility is achieved in part by the compressive, tensile and torsional forces applied to the elastomeric material 13 and the relatively thin parts 9 and 10 as brushing pressure is applied to the head 3 of the toothbrush 1.

**Claims:**

1. A toothbrush made of a plastic material, having a head and a grip handle, all disposed along a longitudinal toothbrush axis, bristles projecting from the head in a bristle direction generally perpendicular to the toothbrush axis, the toothbrush having a head end extending from the head toward the handle, and a handle end extending from the end of the handle remote from the head toward the head, a resiliently flexible link being formed between the head end and the handle end, *characterised* in that;

the link comprises a first plastic material part extending integrally from the head end toward the handle end, and a second plastic material part extending integrally from the handle end toward the head end, the first and second parts overlapping each other longitudinally on either side of an axis substantially parallel to the longitudinal axis and substantially perpendicular to the bristle direction,

between the said first and second plastic material parts there being a resilient flexible elastomeric material bonded to both the first and second plastic material parts.

2. A toothbrush made of a plastic material, having a head and a grip handle, all disposed along a longitudinal toothbrush axis, bristles projecting from the head in a bristle direction generally perpendicular to the toothbrush axis, the toothbrush having a resiliently flexible link being formed between the head end and the handle end, *characterised* in that;

the link comprises a first plastic material part extending integrally from a part of the toothbrush which is relatively nearer to the head, toward the handle, and a second plastic material part extending integrally from a part of the toothbrush which is relatively nearer to the handle, toward the head, the first and second parts overlapping each other longitudinally on either side of an axis substantially parallel to the longitudinal axis and substantially perpendicular to the bristle direction,

between the said first and second plastic material parts there being a resilient flexible elastomeric material bonded to both the first and second plastic material parts.

3. A toothbrush according to claim 1 or 2 characterised in that the toothbrush comprises a head, a neck region and a handle arranged successively longitudinally along the toothbrush, and the link is located between the handle and the neck region.

4. A toothbrush according to claim 1, 2 or 3 *characterised* in that the first and second parts describe bends in the same rotational direction around respective axes aligned substantially in the width direction to form concave surfaces on the inside of the bend, and the respective concave surfaces of the first and second parts face each other.

5. A toothbrush according to claim 4 *characterised* in that the first and second parts may describe arcs of generally "J", "C" or "U" shape, with the axis of the bend of the "J", "C" or "U" shape aligned widthwise across the toothbrush.

6. A toothbrush according to claim 4 or 5 *characterised* in that the respective first and second parts may describe bends of a radius of curvature less than the thickness of the toothbrush in the region of overlap of the first and second parts.

7. A toothbrush according to claim 6 *characterised* in that the first and second parts bend around to such an extent that that they bend right round through 180° or more and extend back in the opposite direction to that from which they extend from their origin at respectively the head end or handle end.

8. A toothbrush according to claim 6 or 7 *characterised* in that the radius of curvature decreases with progressive extension of the part from respectively the head end or handle end, so that the part describes a spiral or part spiral curve.

9. A toothbrush according to any of claims 4 to 8 *characterised* in that the respective first and second parts hook around each other.

10. A toothbrush according to claim 9 *characterised* in that the inner concave surfaces of the bends of the first and second parts face each other across a gap in the plastic material between them.

11. A toothbrush according to claim 9 or 10 *characterised* by a head and a grip handle, all disposed along a longitudinal toothbrush axis, bristles projecting from the head in a bristle direction generally perpendicular to the toothbrush axis, the toothbrush having a head end extending from the head toward the handle, and a handle end extending from the end of the handle remote from the head toward the head,

a resiliently flexible link being formed between the head end and the handle end, *characterised* in that;

the link comprises a first plastic material part extending integrally from the head end toward the handle end, and a second plastic material part extending integrally from the handle end toward the head end,

the first and second parts being bent around respective axes aligned widthwise to the toothbrush, the bent first and second parts so formed being hooked about each other,

between the said first and second plastic material parts there being a resilient flexible elastomeric material bonded to both the first and second plastic material parts.

12. A toothbrush according to any one of claims 4 to 11 *characterised* in that between the first and second plastic material parts there is a gap which is occupied by the elastomeric material of the link, the gap defining a sinuous, tortuous channel through the toothbrush.

13. A toothbrush according to claim 12 *characterised* in that the sinuous tortuous channel between the first and second parts comprises a structure in which layers of rigid plastic material alternate with layers of flexible elastomeric material across the thickness dimension of the toothbrush.

14. A toothbrush according to any of claims 4 to 11 *characterised* in that between the first and second plastic parts there is a gap occupied by the elastomeric material of the link, the gap defining a substantially cylindrical cavity with its cylindrical cavity extending across the width of the toothbrush.

15. A toothbrush according to any one of the preceding claims *characterised* by being made as independent separate parts which are fitted together with their respective first and second parts arranged as in the final toothbrush product to be made, leaving a gap in the plastic material parts between the assembled first and second parts, and the elastomer material is then injected into the gap.

16. A toothbrush according to any one of claims 1 to 14 *characterised* by being made integrally of plastic material with such a gap between the first and second parts and having a link part of plastic material linking the first and second parts.

17. An injection mould suitable for making therein a toothbrush according to any one of the preceding claims.

18. A process for the manufacture of a toothbrush using an injection mould as claimed in claim 17.

Fig.1.

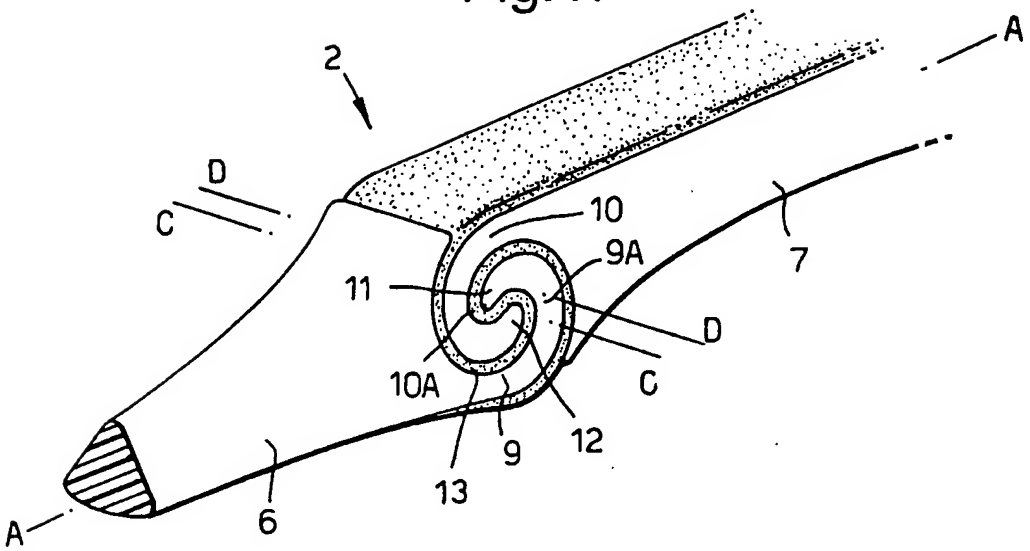



Fig.2.

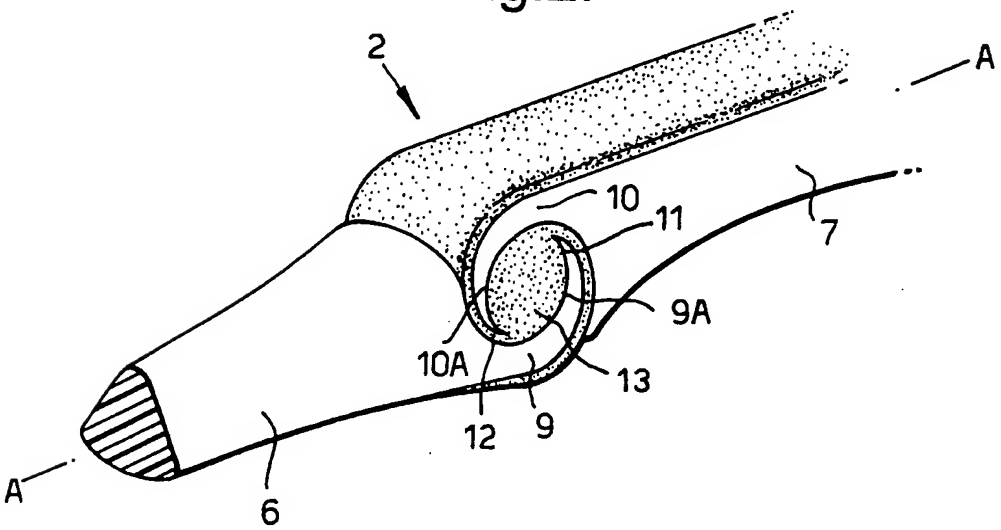


Fig.3.

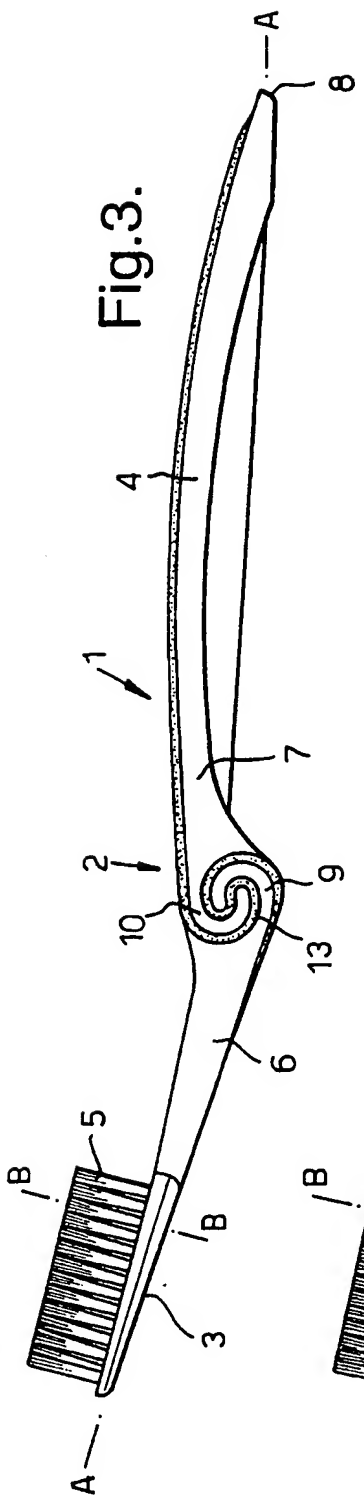



Fig.4.

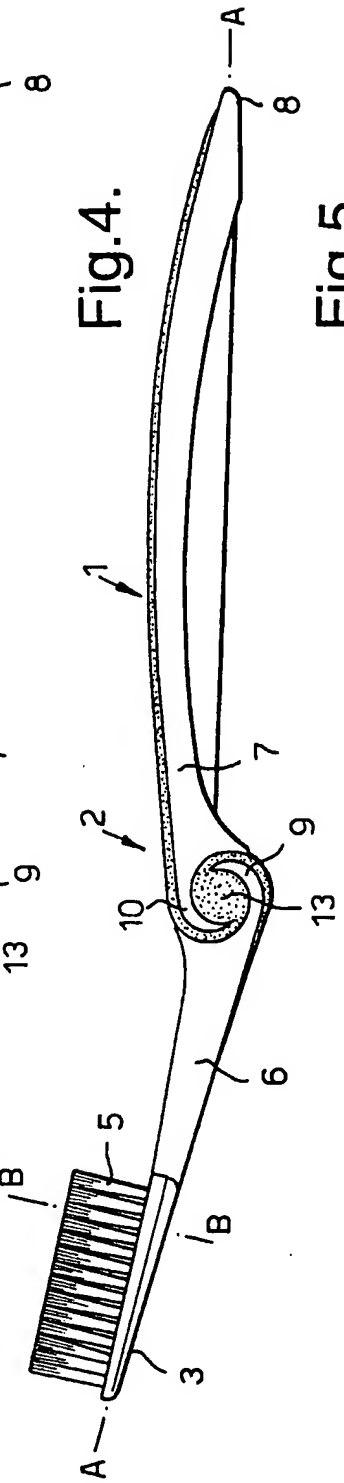



Fig.5.

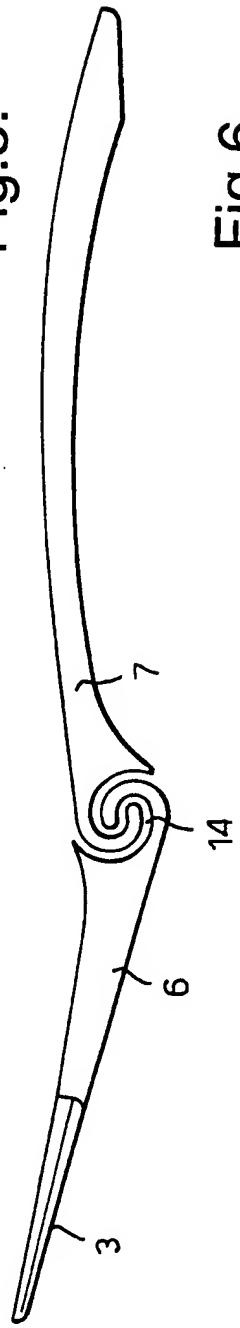
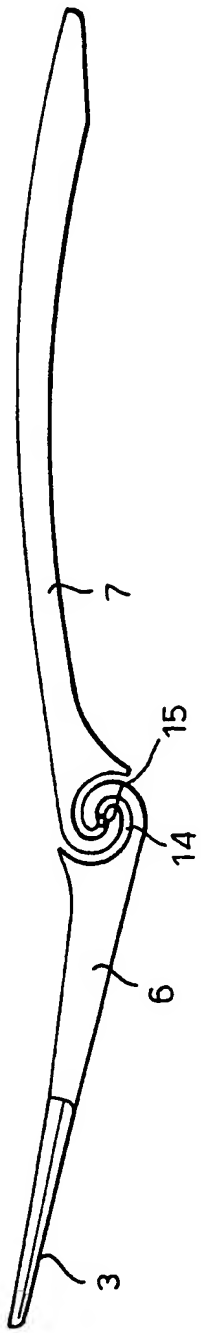



Fig.6.



# INTERNATIONAL SEARCH REPORT

national Application No
PCT/EP 99/00609

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A46B5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A46B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ³ | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | WO 97 02770 A (LINGNER & FISCHER GMBH ;KRAEMER HANS (DE)) 30 January 1997 | 17 |
| A | see page 7, line 5 - line 29; figure 3 | 1,2,18 |
| X | WO 96 28993 A (LINGNER & FISCHER GMBH ;HALM HANS (DE)) 26 September 1996 | 17 |
| A | see page 2, last paragraph - page 3, paragraph 2; figure 3 | 1,2,18 |
| A | DATABASE WPI<br>Section PQ, Week 9713<br>Derwent Publications Ltd., London, GB;<br>Class P24, AN 97-139635<br>XP002104114<br>& JP 09 019323 A (SHISEIDO CO LTD)<br>, 21 January 1997<br>see abstract | 1,2 |

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

³ Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 28 May 1999 | 08/06/1999 |

| Name and mailing address of the ISA | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,<br>Fax: (+31-70) 340-3016 | Wehr, W |

Form PCT ISA/210 (second sheet) (July 1992)

# INTERNATIONAL SEARCH REPORT

| I. ...national Application No |
| --- |
| PCT/EP 99/00609 |

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication,where appropnate, of the relevant passages | Relevant to claim No. |
| --- | --- | --- |
| A | PATENT ABSTRACTS OF JAPAN<br>vol. 098, no. 013, 30 November 1998<br>& JP 10 215950 A (LION CORP),<br>18 August 1998<br>see abstract<br>----- | 1,2 |

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

# INTERNATIONAL SEARCH REPORT

Information on patent family members

I. national Application No
PCT/EP 99/00609

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| WO 9702770 A | 30-01-1997 | AU 6612396 A | 10-02-1997 |
| | | CA 2223482 A | 30-01-1997 |
| | | CN 1190338 A | 12-08-1998 |
| | | EP 0837640 A | 29-04-1998 |
| WO 9628993 A | 26-09-1996 | AU 5272996 A | 08-10-1996 |
| | | EP 0814683 A | 07-01-1998 |